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ABSTRACT

The report describes a project designed to facilitate the transfer and utilization of training technology by developing a model for evaluating training approaches or innovtions in relation to the requirements, resources, and constraints of specific training settings. The model consists of two parallel sets of open-ended questions--one set concerning the characteristics of the training approach under consideration, and one set concerning the requirements, resources, and constraints in the specific training setting. When these questions have been answered, the information needed to evaluate how well the training approach fits the training setting is available and arrayed in a convenient format. The model can be used: when the training setting is given and the problem is to select training approaches; to analyze and describe training approaches in terms relevant to the concerns of the training designer and developer; and to make an inventory of the characteristics of a training setting, without any particular training approach in mind. The report also includes chapters on: background; description of the model (including its development and initial testing); field evaluation and revisions; discussion of the model; applications; and conclusions and implications. An appendix presents an application of the model to a peer instruction training approach. (Author/PR)

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Technical Report 74-24
HumRRO-TR-24-74

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Transfer and Use of Training Technology: A Model for Matching Training Approaches With Training Settings

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A model for evaluating training approaches or innovations in relation to the requirements, resources, and constraints of specific training settings was developed. The model consists of two parallel series of questions, one concerning the characteristics of the training approach under consideration, and one concerning the corresponding characteristics of the training

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settings (including the abilities and other characteristics of trainees, and the characteristics of the training content). The model has been evaluated by subjecting it to the criticism of training managers and curriculum designers in Air Force Technical Training Centers, and by applying it to a training approach and to a training setting.

SUMMARY AND IMPLICATIONS

OBJECTIVES

The objective of this project is to facilitate the transfer and utilization of training technology by developing a model for evaluating training approaches or innovations in relation to the requirements, resources, and constraints of specific training settings.

APPROACH

The approach taken in developing the model for matching training approaches with training settings was to construct two parallel sets of open-ended questions—one set concerning the characteristics of the training approach under consideration, and one set concerning the requirements, resources, and constraints in the specific training setting. When these questions have been answered, the information needed to evaluate how well the training approach "fits" the training setting is available and arrayed in a convenient format.

The term "training approach" is intended as a neutral term to include any method, technique, device, or system considered for use in training. Examples range from simple audiovisual devices intended to support an ongoing program of training, to comprehensive training systems the adoption of which would revamp large elements of the training organization. Some training approaches may be truly innovations; others may already have been used in a variety of other training settings.

The term "training setting" is intended to include the physical and personnel resources of the training organization; the policies and requirements of the personnel and training administrative systems involved; the abilities, previous experience, physical characteristics, and attitudes of the trainees; and the nature of the training content, as described in training objectives.

The model was developed by first considering a number of training approaches and asking the question, "What features do these training approaches have that would make a difference in their suitability for use in various training settings?" From the answers to this question for a number of training approaches, a preliminary outline of characteristics was developed and applied to several training approaches.

At this point attention was shifted to various features known to be involved in military training settings, and the question was asked, "Do these features of training settings make a difference in the feasibility or suitability of various alternative training approaches for use in these training settings?" If the answer appeared to be "Yes," these features of the training settings were incorporated into the outline of characteristics. The outline of characteristics was then recast into two parallel sets of questions, one for training approaches and one for training settings.

This preliminary version of the model was then taken to the field in extensive interviews and discussions with training managers and curriculum designers at several Air Force Technical Training Centers.

RESULTS

Following the suggestions of the training managers and curriculum designers interviewed at the Technical Training Centers, the model was revised extensively to place

more emphasis on questions concerning costs of training and the availability of resources in training settings, to incorporate terminology more familiar to Air Force personnel, and to add numerous questions.

The revised model was then applied to a training approach (peer instruction) with considerable success, and to a training setting (the Law Enforcement Specialist course at Lackland AFB) with somewhat less success, because needed information was not available at a distance from the training setting.

IMPLICATIONS

The model for matching training approaches with training settings has aroused considerable interest. Support has been forthcoming for continued work in applying the model to training approaches and training settings in an Air Force Technical Training Center. It is planned to actually develop a new course and implement it as a part of this effort.

PREFACE

This report describes work performed by the Human Resources Research Organization during the first year under Research Project AFTEC, Basic Research Relevant to U.S. Air Force Technical Training, for the Air Force Office of Scientific Research. The development of a model for evaluating training approaches in relation to specific training settings is discussed in this report. Further refinement and evaluation of the model is under way.

The research is being conducted at HumRRO's Eastern Division, Alexandria, Virginia. Dr. J. Daniel Lyons is Director of the Division, and Dr. Edgar M. Haverland is principal investigator for the project. The research was begun at Division No. 7 (Social Science) before it became part of the Eastern Division; Dr. Robert G. Smith, Jr., was Director of Division No. 7, and was a member of the research team that gathered information at Air Force Technical Training Centers. Dr. Eugene A. Cogan contributed guidance and stimulating suggestions during the conceptualization and development of the model.

This project is being conducted for the Air Force Office of Scientific Research (AFOSR) under Contract F44620-74-C-0007. This report has been submitted to AFOSR as an Interim Scientific Report.

Meredith P. Crawford
President
Human Resources Research Organization

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Transfer and Use of Training Technology: A Model for Matching Training Approaches With Training Settings

Chapter 1

BACKGROUND

INTRODUCTION

Training in the U.S. Air Force is characterized by massive coverage of a wide range of content, and by the necessity for frequent revision or replacement of substantial portions of the vast array of training materials, in order to keep pace with changing requirements and programs. In one recent year, it was estimated that of the 300,000 hours of different kinds of training being presented in the Air Training Command, between 50,000 and 75,000 hours were being phased out, to be replaced by new training material covering different content and between 50,000 and 60,000 hours were being revised.[1]

Much of this training is quite expensive, and some of it involves large numbers of students. In technical training alone, the Air Force spends over half a billion dollars and graduates more than 150,000 persons a year from five technical schools and numerous on-the-job training courses (Carpenter, 1972). Thus, improvements in the effectiveness of training have the potential for saving large amounts of money.

In a training system in which more than one-third of the training is being revised or developed during any given year, and in which so much money is spent and so many persons trained, the effectiveness of the training development process is crucial in determining the efficiency of the system. As training is developed or revised, there is always the opportunity to choose more effective training approaches. In developing training for any particular setting, there will always be a wide range of approaches from which to choose, some genuinely new and innovative, and some, while already in use in other settings, new to the particular setting. Effective use of training technology depends heavily on careful evaluation and wise choice of training approaches in the training development process.

OBJECTIVE

The objective of this project is to contribute to the effective use of training technology through the development of a model for evaluating training approaches or innovations in relation to specific training settings. The applicability or potential usefulness of the training approach or innovation in a particular training setting is evaluated by systematically comparing the characteristics of the training approach or innovation with the corresponding characteristics or requirements of the training setting.

DEFINITIONS

The term "training approach" is intended to include any method, technique, device, or system considered for use in training. Examples range from simple audiovisual devices intended to support an ongoing program of training, to comprehensive training systems,

[1] Personal communication with Chester L. Bueker, 31 October 1973.

the adoption of which would revamp large elements of the training organization. Earlier work in this project used the term "training innovation," but "training approach" has been adopted as a neutral term to signify any method, technique, device, or system being considered for adoption in a training setting, whether it is truly an innovation, or has already been used in a variety of other training settings.

"Training setting" is also intended to be a neutral term with wide applicability. For example, a particular training setting could be defined in relation to an entire course, lasting many weeks, to a major portion of such a course, or to a small segment of it, dealing with a particular topic or skill and lasting for a few days or even hours.

The term "training setting" is intended to include (a) the nature of the training content, as embodied in the training objectives for the course or portion of the course; (b) the physical and personnel resources of the training establishment—including the buildings or classroom or other space available for the course or portion thereof, training or operational equipment, and instructional and supervisory personnel; (c) the policies and requirements of the personnel and training administrative systems involved—as well as general policies and constraints of the training center or agency responsible; (d) the abilities, previous experience, physical characteristics, and attitudes of the trainees.

This model can be applied in several ways. It can be used when the training setting is given and the problem is to select training approaches, either for insertion into an ongoing training program, or in developing a new course or program. It can also be used to analyze and describe training approaches in terms that should be more relevant to the concerns of the training designer and developer than are the research reports and journal articles normally used to disseminate information about training methods and techniques.

Finally, the model can be used to make an inventory of the characteristics of a training setting, without any particular training approach in mind. From the information obtained, the training manager or planner could make inferences about the kinds of training approaches that would be useful in this training setting. This approach might be especially useful in developing, from the beginning, a new course or training program.

RELATIONSHIP OF PROJECT TO RESEARCH LITERATURE

Research literature on social and organizational change is extensive and varied (Bennis, Benne, and Chin, 1969; Havelock, *et al.*, 1969; Sashkin, Morris, and Horst, 1973). The many studies in this literature deal with numerous areas of change (in medicine, education, agriculture, transportation, and general technology, for example), and with various aspects of the change process, such as the role of change agents, the influence of mass media, the communication process generally, resistance to change, and conceptualizations of the change process.

This project deals with an aspect of the vast subject of social and organizational change that has not received much attention in any of this literature—the explicit consideration of the user's needs and requirements as a basis for choosing the particular change or innovation to be implemented. The problem-solver model for social change (Havelock, *et al.*, 1969, Chapter 2, pp. 40-41) does give user needs a central place in the change process, and the work of Niehoff (1969) on the factors determining the success or failure of efforts to introduce planned changes in primitive or underdeveloped societies strongly emphasizes the importance of users' needs, as perceived by the users themselves, in determining success or failure of attempted innovations. Otherwise, this literature is much more concerned with the processes and techniques of getting changes accepted and implemented, than with the choice of what changes to attempt.

This project may be viewed as a contribution to a relatively neglected aspect of the study of social and organizational change, although its primary importance lies in its potential contribution to more effective Air Force training.

SCOPE OF THE REPORT

This report describes the development of a preliminary version of the model, its evaluation by Air Force training personnel in the field, and its subsequent revision. The current version of the model, with supporting materials, is presented in stand-alone form. There is discussion of the relationships of the model to Instructional System Development (ISD) procedures (Department of the Air Force, 1970), the Rand Corporation's system for designing programs of instruction, MODIA—A Method of Designing Instructional Alternatives (Carpenter, 1972; Carpenter and Horner, 1972; Bretz, 1972; and Petruschell and Carpenter, 1972), and to the Advanced Instructional System (AIS) (Rockway and Yasutake, 1973). The application of the model to several training approaches and training settings is described.

Chapter 2

DESCRIPTION OF THE MODEL

PURPOSE OF THE MODEL

The specific purpose of the model is to facilitate, and provide a format for, the systematic gathering and arranging of information on the characteristics of training approaches and training settings so that the "fit," or potential usefulness of a particular approach in a particular setting, can be evaluated.

The procedure has been, essentially, to ask a series of questions about the training approach under consideration, and a parallel series about the training setting. Thus, the function of the model is to aid in eliciting and arranging information so that all relevant information is obtained and arrayed in a way that facilitates decision-making. The final decision concerning the extent to which the training approach fits this particular training setting remains a matter for judgment, but good, sound judgment should be made much easier and more likely if the relevant information is available and clearly displayed.

INITIAL DEVELOPMENT OF THE MODEL

The derivation of this model was begun by considering a number of training approaches and asking the question, "What features do these training approaches have that would make a difference in their suitability for use in various training settings?" From the first tentative answers to this question, the following preliminary outline of characteristics emerged:

(1) Student Characteristics
   a. Is the training approach sensitive to aptitude variations?
   b. What is the minimum number of students required for the approach to be feasible? How does the approach handle much larger numbers of students?
   c. What is the size of student groups required or desirable for the approach, and how are they organized?
   d. Are any special aptitudes or capabilities required of the students (e.g., reading ability at a specified level)?

(2) Instructor Characteristics
   a. What is the minimum number of instructors required? Instructor-student ratio?
   b. What special skills or training do the instructors need?
   c. What roles do instructors play in implementing the training approach (i.e., what is the nature of the activities required of instructors—presenting information, managing student learning activities, evaluating student performance)?

(3) Training Content Characteristics
   a. For what types of content is this training approach particularly appropriate?

b. What implications does the training approach have for the organization and sequencing of training content?
c. How much effort is necessary to develop and to revise training materials for this training approach?

(4) Physical Setting Characteristics
a. How much and what kind of space (classroom, laboratory, field maneuver) does this training approach require?
b. Is operational (or nonoperational) equipment required with this training approach?
c. Are training devices required, and what level of fidelity is needed?
d. What are the requirements for printed training material?
e. Is this training approach suitable for use at dispersed or remote sites?

It may be noted that this preliminary outline of characteristics is categorized in terms of major elements of the training setting—students, instructors, training content, and physical setting. This classification was not preconceived; it simply emerged as a natural classification for the kinds of characteristics that were obtained as answers to the question "What features do these training approaches have that would make a difference in their suitability for use in a particular training setting?"

TESTS OF THE PRELIMINARY OUTLINE OF CHARACTERISTICS

The preliminary outline of characteristics was then used in examining a number of training approaches to obtain an indication of the feasibility of this manner of developing the model. Some of the training approaches selected for examination were abstracted from HumRRO training research, and were intended to represent the kind of fundamental, systematic approaches to training that appeared to offer substantial possibilities of improvement in the effectiveness of training. Also, because of their relatively fundamental and comprehensive nature, they are likely to be more difficult to evaluate than simpler training approaches involving, for example, a new audiovisual device. Thus, the first tests of this developing model were of substantial difficulty and scope.

Also included in the training approaches selected for examination was the Lincoln Training System, which depends completely on a sophisticated piece of instructional equipment. This training approach was selected in order to extend the tests of the developing model in the direction of instructional equipment, since Air Force instructional programs are making increasing use of this kind of equipment.

The training approaches examined, with the preliminary outline of characteristics and the nature and results of that examination, are described in the following sections.

Peer Instruction

This training approach and the following one (Mastery Testing) were abstracted from the research conducted under HumRRO Work Unit APSTRAT (Weingarten *et al.*, 1972).

> The Peer Instruction Training Approach is defined as a system of instruction in which student instructors who have successfully completed a module of training are paired with student learners just entering the module. First, the student instructor demonstrates all of the activities to be learned in the module while the student learner observes. Then the student learner practices the activities under the guidance of the student instructor (peer instructor) until he can perform them satisfactorily. The student learner then becomes a peer instructor and is paired with a new student learner to carry out the demonstration and peer instructional activities with him, while his former peer instructor either exits the module and enters another module as a student learner, or graduates from the course.

(1) Student Characteristics
   a. Insensitive to aptitude variations
   b. Minimum number of persons must be in training, depending on number and length of modules, for efficient use of instructional materials and equipment; large numbers of students handled by multiple learning stations for each module
   c. Rotating groups of three students at each learning station—instructor, learner, and observer
   d. No special aptitudes required, except as demanded by training content; one-to-one instructor-learner ratio provides maximum flexibility to adapt to requirements of individual student-learners

(2) Instructor Characteristics
   a. Number required-relatively few; instructor-student ratio—not critical
   b. Special skills or training—none, other than reasonably proficient in training content involved
   c. Role of instructors—managers and schedulers of instruction

(3) Training Content Characteristics
   a. Appropriate for a wide variety of types of content
   b. Implications for organization and sequencing of training content—must be modularized, in order to set up learning centers; modularization should facilitate sequencing so that prerequisite learning is accomplished
   c. Training development and revision effort—requires careful analysis of training content so as to modularize the content and set up learning stations; training revision effort should be relatively small since modularization facilitates revision

(4) Physical Setting Characteristics
   a. Requires a lot of space, since one or more learning stations must be set up for each module of content; type of space depends on training content
   b. Operational equipment may or may not be required, depending on other aspects of learning situation, such as whether simulation is used
   c. Requirements for training devices—depends on training content, and whether use of operational equipment is feasible
   d. Requirement for printed material—minimal (administrative and record-keeping only) if job-related equipment is used; if learner activities involve printed material, there is a larger requirement
   e. Dispersed or remote sites—probably not, unless operational equipment on such sites is used with traveling administrator-trainer teams

Mastery Testing (With Modularized Training)

The Mastery Testing Training Approach is defined as a procedure in which students are required to demonstrate acceptable performance on a module of training content before being allowed to continue with the next module. Students who cannot demonstrate acceptable performance in a mastery test must study or practice further and pass the mastery test before continuing with another module.

(1) Student Characteristics
   a. Insensitive to aptitude variations
   b. Numbers of students required or permitted not crucial; large numbers of students can be accommodated by having multiple testing stations for each module
   c. No necessary implication for size or organization of student groups
   d. Special aptitudes required; depends on performance being tested

(2) Instructor Characteristics
   a. Number required—depends on number of modules of training content and number of students; not particularly heavy requirements for instructors
   b. Special skills or training—test administration, quality control orientation
   c. Role of instructors—test administrators, with responsibility for quality control (i.e., insuring that students have mastered training content)
(3) Training Content Characteristics
   a. Type of content appropriate; suitable for a wide variety
   b. Implications for organization and sequencing of training content—requires modularization of training content, approach is particularly appropriate if some parts of training content are clearly prerequisite to others
(4) Physical Setting Characteristics
   a. Amount and kind of space needed—depends on nature of job performance being trained
   b. Requirement for operational equipment—desirable when possible, but simulated performance can be used
   c. Requirements for training devices—desirable if possible for more realistic testing in some cases (fidelity requirements depend on training content)
   d. Requirements for printed material—minimal, unless testing procedures require a great deal of printed material
   e. Dispersed or remote sites—normally not, but could be done with traveling testing teams

Lincoln Training System (LTS-4)

This training approach was taken from the description of the equipment provided by Frick (1973), and its use in demonstrating an economical method for preparing proceduralized instructional material (Frick and Karp, 1973).

> The Lincoln Training System Training Approach is defined as a computer-controlled, stand-alone microfiche system that combines visual images, voice-quality sound recordings, and computer control logic on the same fiche. Under computer control, the system can select any of up to 750 microfiche, each with 12 images and 12 associated audio frames, with up to 28 seconds of speech on each frame. The system presents individualized, interactive instruction utilizing both visual and auditory modes of presentation.

(1) Student Characteristics
   a. Aptitude level of students—not applicable; depends on nature of instructional material designed for use in equipment
   b. Number of students—one per terminal while in use
   c. Organization of students—none—individualized instruction
   d. Special aptitudes—audio facility helps solve the problem of poor readers
(2) Instructor Characteristics
   a. Number required—minimal
   b. Special skills or training—minimal, assuming instructional material is good
   c. Role of instructors—minor involvement (issuing sets of fiche, record keeping, etc.)
(3) Training Content Characteristics
   a. Type of content appropriate—wide range possible
   b. Implications for organization and sequencing of training content—small step inherent in system, flexible sequencing possible, system has random access capability

c. Training development and revision effort—development effort varies widely depending on approach taken in analyzing training content, equipment does *not* impose burdens here. Training revision effort is less than for comparable printed materials, since large production volumes are not needed for economy in making microfiche, as with printed materials

(4) Physical Setting Characteristics

a. Space requirements—indoors; amount needed for one terminal per student during the time on the system
b. Requirements for operational equipment—depends on how it is used (can be used as a job aid in operating or maintaining operational equipment, or as a stand-alone training system)
c. Requirements for training devices—probably none
d. Requirements for printed materials—little or none
e. Can be used at dispersed and remote sites for individual instruction

Operational Context Training

This training approach was taken from the report of a HumRRO research project (Work Unit LOCK-ON) carried out some years ago (Woolman, 1960). It was chosen in order to extend the tests of the developing model into the area of on-the-job training, and because the approach, as applied in the original HumRRO study, produced a rich amalgam of training techniques well adapted to the constraints and requirements of the field training situation for which it was designed.

The Operational Context Training Approach is defined as a flexible, decentralized method of OJT, utilizing as its primary training unit a group consisting of one instructor skilled and experienced in the job to be trained (but not in instruction techniques) and two students. The method also involves:

- A Training Guide that describes the method generally and provides specific guidance on the procedures or skills to be learned by students.
- An elementary method of instruction for the guidance of novice instructors.
- Training content organized in modules or blocks, with
- Proficiency-based advancement in training, based on
- A simple six-point rating scale used by the training unit instructors during training and by training supervisors for qualifying students to advance to a later module of training.
- A system of records and charts to record and display student progress for both information and motivational purposes.
- An interviewing and counselling system to deal with students whose performance is unsatisfactory.

The method is designed to be used in a field or operational setting, and depends heavily on relatively low-level personnel who are given explicit guidance in following the system.

(1) Student Characteristics

a. Insensitive to aptitude variations
b. Flexible as to numbers of students
c. Two students to each instructor
d. No special aptitudes required

(2) Instructor Characteristics

a. One instructor for every two students, with five or more such training units, one chief instructor, and two or more supervisory (check-out) instructors for each platoon-size unit
b. No special skills, beyond those of the performance being taught—complete instructor guidance provided in the method

c. Role of instructors—demonstrate performances, observe and critique students' practice, and evaluate performance. Supervisory instructors administer proficiency tests or ratings. Chief instructor supervises and monitors training program for platoon

(3) Training Content Characteristics
   a. Type of content appropriate—should be suitable for wide variety of procedural jobs.
   b. Modularized training content, sequenced according to prerequisites, otherwise modules can be studied in any order, subject to equipment availability

(4) Physical Setting Characteristics
   a. Space requirements—none beyond that required by the operational equipment
   b. Designed for use on an as-available basis with operational equipment
   c. Requirements for training devices—probably none, since operational equipment will usually be used
   d. Requirements for printed material—*Training Guide* and record-keeping forms
   e. Dispersed or remote sites—yes, if operational equipment is so located

As these training approaches were examined, it appeared clear that they could be evaluated with respect to the characteristics presented in the preliminary outline. Further, it was felt that the product of such evaluations would be a summation of the significant factors to be considered in making decisions concerning the suitability of these training approaches for use in particular training settings.

AMPLIFICATION OF THE MODEL

At this point attention was shifted to various features known to be involved in military training settings, and the question was asked, "Do these features of training settings make a difference in the feasibility or suitability of various alternative training approaches for use in these training settings? If the answer appeared to be "yes," these features of the training settings were incorporated into the outline of characteristics.

Some of the items in the amplified outline of characteristics appeared to relate more to training approaches, and others more to training settings. Since the model was expected to relate to both, and to serve a kind of mediating function between them, the amplified outline of characteristics was then recast explicitly into two parallel, coordinated series of questions. One series of questions was directed at the training approach being considered, and the other series at the training setting involved.

A brief outline of this interim version of the model is presented here.[1] For this version, which was used in the field evaluation described in the following chapter, each of the elements in the following outline involves one or more questions concerning the training approach, with parallel questions for the training setting.

STUDENT CHARACTERISTICS
   A. Implications of student aptitude levels
   B. Numbers of students

[1] This version of the model was developed in an interim report by Edgar M. Haverland in March 1974.

C. Special skills or physical characteristics of students
D. Implications of sex of students

INSTRUCTOR CHARACTERISTICS

A. Number of instructors
B. Special skills or training of instructors
C. Implications for roles to be played by instructors

CHARACTERISTICS OF TRAINING CONTENT

A. Kinds of student performances
B. Organization of training content
C. Kinds of instructional activities
D. Effort necessary to make changes in training content

MATERIEL AND FACILITIES

A. Space for conducting training
B. Equipment and materiel
C. Training locations/situations (formal school, on-the-job training, dispersed locations, remote sites)

ADMINISTRATIVE CONSIDERATIONS

A. Student flow
B. Individualization of instruction
C. Fixed standard level of skill expected of students, or each student develop his capabilities as far as he can
D. Management information

COST FACTORS

A. Capital expenditures
B. Operating expenses
C. Training development costs
D. Miscellaneous costs

Chapter 3

FIELD EVALUATION AND REVISION OF THE MODEL

PURPOSE OF FIELD EVALUATION

The field evaluation conducted in this project had two purposes: (a) to subject the model to criticism by the Air Force training personnel who are its potential users, and (b) to obtain information concerning a number of training settings so that the revised model could be applied to some of these training settings. The version of the model taken to the field was described in Chapter 2 of this report.

SOURCES OF INFORMATION

Since this project was undertaken in the context of Air Force technical training, information was gathered by a team of two researchers at Air Force Technical Training Centers at Chanute AFB, Rantoul, Ill., Keesler AFB, Biloxi, Miss., Sheppard AFB, Tex., and Lowry AFB, Denver, Colo., as well as at the Military Training Center at Lackland AFB, San Antonio, Tex. All of these Centers are elements of the U.S. Air Force Air Training Command.

Criticism of the model was obtained mainly from personnel of the Curriculum Branches of the Operations Divisions in the Schools of Applied Aerospace Sciences, and from chief instructors and instructor supervisors in the instructional departments.

Information concerning training settings was obtained by observing training activities, discussing the process and problems of innovation in training with personnel ranging from department and division directors to instructors, and by obtaining documentation on selected courses for later study.

SUMMARY OF INFORMATION OBTAINED

The primary method for obtaining criticism of the model was to request that a meeting of 7 to 15 curriculum and supervisory instructor personnel be convened at each Center, and to present the model to them for their reaction. The meetings lasted from one to three hours. After those present had been acquainted with the objective of the project and the intended use of the model, the model was worked through section by section. Some of the topics discussed included (a) whether the information needed to answer the questions in the model was available; (b) whether any of the questions were inappropriate or irrelevant; and (c) what additional questions should be asked.

Although at times in these meetings it took some effort to establish communication, the discussions were, variously: intense, interesting, constructive, explosive, critical, complimentary, and helpful. In short, the meetings were anything but dull.

The major points made in criticism of the model were the following:

(1) Cost considerations are paramount in considering possible changes in training procedures and methods, and the order of topics in the model should be changed so that questions about costs are answered first.

(2) The model should be written in terms familiar to the intended users. For most people, this meant that the terminology and concepts used in the model should be those used in Air Force and Air Training Command Regulations.
(3) Delays in obtaining instructional materials, equipment, and personnel are important when making any substantial change in training procedures and methods, and should be given more explicit attention in the model.
(4) The various roles that instructors may play in different training approaches, the difficulties of changing the roles that instructors play when implementing a new training approach, and some definitions of various kinds of instructional personnel should be made more explicit in the model.

In addition to these major points, dozens of detailed suggestions were made.

The model was revised, taking into consideration all of the information obtained, and is presented in Chapter 4 of this report.

In gathering information concerning training settings, the research team asked the personnel interviewed to think of substantial changes that had recently been made in the training for which they were responsible, and to discuss the process by which the decision to change the training was reached, as well as the difficulties encountered in implementing the changes.

Nearly everyone had either participated in the implementation of a substantial change in training, or knew of the experience of another department that had done so. The most frequently encountered change in training involved converting a course or a major portion of a course (usually from group lock-step instruction) to self-paced instruction. These conversions were accomplished by devising activities, usually programmed textbooks or exercises involving operating or checking equipment, which students could do largely or entirely on their own. Instructors were there to help, if necessary, and to administer tests covering segments or modules of the instruction, which students were required to pass before going further in the course.

These substantial changes in training had usually been made at the direction or suggestion of Headquarters, ATC, although in some cases individual training managers had taken the initiative in implementing the change.

The most important consideration in deciding whether to implement the new training approach was always cost, thus verifying the major change recommended in the model. Changes in training were possible only if they could be implemented with available resources, or in some cases with a small amount of additional resources (funds, personnel, physical facilities, and equipment). Other factors, such as projected student flow, quality of graduates' performance, and the need for reorienting or retraining instructors, played a part in some of the decisions, but were not consistently involved.

In summary, no evidence was found in these discussions, which took place in 15 different instructional departments, of a decision process nearly as comprehensive as the model would provide for matching training approaches with training settings.

At each Technical Training Center visited, the research team requested and received documentation for several representative courses. For each course, this documentation consisted of the Specialty or Course Training Standard (STS or CTS), the Course Chart, and the Program of Instruction (POI). These course documentation materials, supplemented by the observation and interviewing done by the research team, provided the basis for the applications of the model to training settings described in Chapter 6 of this report.

REVISION OF THE MODEL

The major revision to the model was the reordering of the major sections so that costs, or more generally, resources, are considered first. Also a short section, Objectives, was added to the beginning to focus attention on what should be accomplished by adopting a new training approach.

Air Force and Air Training Command terminology was used somewhat more in the revised model so that it is, to a considerable extent, "tailored" for Air Force technical training. However, general terminology was retained to some extent in the model so that its potential application in a much wider context of training technology than Air Force technical training would be recognizable.

Delays in obtaining instructional materials, equipment, and personnel, and other administrative and logistical problems involved in implementing a new training approach, were given considerably more attention in the revised model. Generally, more explicit emphasis was placed on the management of instructional equipment and materials, instructional personnel, and students.

The revised model also goes into more detail about the kinds of activities in which instructors engage, the problems of changing the roles of instructors when new training approaches are implemented, and the kinds of auxiliary personnel that are needed in some instructional systems. In conversions of courses to the self-paced mode, the problems of changed roles for instructors and of retraining instructors to work constructively and effectively with students in a self-paced course had been mentioned frequently, so these aspects were incorporated in the revised model.

Chapter 4

THE MODEL

The model is presented in this chapter with supporting materials as it might be used independently of this report as a separate, stand-alone method for matching training approaches with training settings. It is in the form in which it might be given to Air Force training managers and planners for use in their work.[1]

Introductory and explanatory material is presented with the model to facilitate its use. After more experience in using the model has been accumulated, it should be possible to specify a definite step-by-step procedure for matching training approaches with training settings, as well as to improve the model itself.

[1] A limited number of copies of this model as a separate, stand-alone document are available. Requests should be sent to Dr. Edgar M. Haverland, Eastern Division, Human Resources Research Organization, 300 North Washington Street, Alexandria, Va. 22314.

Training Approach

Notes

OBJECTIVES

What is the general nature of the evidence that indicates that this training approach might improve the performance of the training system or solve the problems affecting it? (Answers to later questions in this model will explore this in more detail.) The following list describes some benefits that might be gained by adopting a new training approach:

- Reduce student attrition
- Improve job performance of graduates
- Save training time
- Reduce training costs
- Adapt course to students of lower (or higher) aptitude than previously
-
-

RESOURCES REQUIRED

A. Implications of training approach for costs.

1. What capital expenditures will be necessary if this training approach is implemented? Examples of capital expenditures—new or remodeled facilities, or equipment purchases.
2. What kinds and amounts of operating expenses will be involved if this training approach is implemented? Areas in which operating expenses may be important include personnel, physical facilities, and instructional materials.
3. If this training approach is implemented, what kinds and amounts of training development costs will be incurred? Both initial training analysis and development costs (job analysis, training content analysis, development of the instructional system, and development of the training materials) and the cost involved in repeating these analysis and development steps when the training content is changed, should be considered.
4. When all costs of implementing this training approach are considered and these costs are distributed over the number of students likely to be trained, how does the cost per student compare with that of alternative training approaches?

Notes

OBJECTIVES

What are your objectives with respect to this training setting? What goals would you like to see the training system attain? What problems do you see in the training system that need to be solved? The following list describes some goals that might be achieved by analyzing the training setting and making some changes:

- Reduce student attrition
- Improve job performance of graduates
- Save training time
- Reduce training costs
- Adapt course to students of lower (or higher) aptitude than previously
-
-

RESOURCES AVAILABLE

A. Availability of funds in this training setting.

1. Are the funds available in this training setting to cover the capital expenditures necessary to implement this training approach?

2. Are funds available in this training setting to cover the operating expenses that this training approach would involve?

3. Does this training setting provide for necessary training development costs, both when the training approach is initially implemented, and when changes in training content make it necessary to partially repeat the training development steps?

4. What is the current cost per student trained in this training setting?

Notes

5. Will this training approach permit the sharing of expensive facilities or equipment with other courses, or with operational uses?
6. Will implementation of this training approach result in some equipment no longer being necessary?

B. Materiel and facilities requirements for this training approach.

1. For what kinds of training locations or situations is this training approach suitable? Examples are shown in the following list (additional kinds of locations or situations should be considered if appropriate):
   - Formal school training, of a continuing nature
   - Special school training, of a one-time nature
   - Basic military training
   - On-the-job training
   - Field training
   - Learning resource center
   - Dispersed locations
   - Remote sites
   -
   -
2. Space requirements.
   a. What kinds of space are needed to use this training approach with the training content being considered? Examples of kinds of space:
      - Classroom
      - Laboratory
      - Practical exercise facilities
      - Outdoor ranges or maneuver areas
      - Storage
      -
      -
   b. What amounts of the various kinds of space are needed (at least in relative terms) when comparing training approaches?
   c. What elements in the training approach or method are related to space needs? Examples:
      - One classroom for each class of _____ students.
      - One terminal for each student using the system.
      - One learning station for each module of content
      -
      -

Notes

5. Are there in this training setting facilities or equipment used in other courses, or for operational purposes, that could be used with this training approach?

6. Will turning in unneeded equipment result in savings in operating or maintenance expenses?

B. Materiel and facilities available in this training setting.

1. What kinds of training locations or situations can be provided in this training setting? Examples are shown in the following list (additions to this list should be made if needed):
   - Formal school training, of a continuing nature
   - Special school training, of a one-time nature
   - Basic military training
   - On-the-job training
   - Field training
   - Learning resource center
   - Dispersed locations
   - Remote sites
   -
   -

2. Space availability.
   a. What kinds of space are available in this training setting? Examples of kinds of space:
      - Classroom
      - Laboratory
      - Practical exercise facilities
      - Outdoor ranges or maneuver areas
      - Storage
      -
      -

   b. How much of the kinds of space needed are available in this training setting?

   c. How is the space available in this training setting divided or furnished? Examples:
      - Classrooms or laboratories of various sizes
      - Topography of outdoor range or maneuver areas
      -
      -

Notes

d. Does the training approach require that the space to be used have special utilities or characteristics? Examples:
   - Electric power requirements
   - Air conditioning and ventilation requirements
   - Lighting requirements
   - Floor loading capacity
   -
   -

e. Are environmental extremes (heat, cold, humidity, etc.) important considerations in using this training approach?

3. What kinds of equipment and materiel are required to use this training approach with the training content being considered? The following list suggests kinds of equipment and material that may be needed (additional types of equipment and material should be listed if needed):
   - Operational equipment
   - Nonoperational equipment
   - Audiovisual equipment
   - Films, audio and video cassettes
   - Part-task training devices
   - Low-fidelity simulators
   - Large, high-fidelity simulators
   - Training aids (charts, transparencies, cut-away equipment, etc.)
   - Study guides, Technical Orders, or other printed training material
   - Job performance aids
   -
   -

4. Instructional equipment and materials management.
   a. If this training approach is implemented, and equipment of any complexity is to be used in the training, does the projected utilization schedule for the equipment provide time for maintenance?
   b. Is this training approach compatible with the use of training materials with a security classification?
   c. Does this training approach require the use of copyrighted materials?
   d. In planning for the implementation of this training approach, have allowances been made for the lead time necessary to obtain any needed equipment?

Notes

d. Does the space available in this training setting have any special utilities or characteristics that are needed? Examples:
   - Electric power requirements
   - Air conditioning and ventilation requirements
   - Lighting requirements
   - Floor loading capacity
   -
   -

e. Are there environmental extremes (heat, cold, humidity, etc.) to be considered in this training setting?

3. What kinds and amounts of equipment and materiel for conducting training are available or can be obtained in this training setting? The following list suggests the kinds of equipment and materiel that may be available (additional types of equipment and materiel should be listed if needed):
   - Operational equipment
   - Nonoperational equipment
   - Audiovisual equipment
   - Films, audio and video cassettes
   - Part-task training devices
   - Low-fidelity simulators
   - Large, high-fidelity simulators
   - Training aids (charts, transparencies, cut-away equipment, etc.)
   - Study guides, Technical Orders, or other printed training material
   - Job performance aids
   -
   -

4. Policies and resources affecting instructional equipment and materials management in this training setting.
   a. Are the resources and skills needed to maintain equipment used in training available in this training setting?
   b. Will the use of training materials with a security classification be necessary in this training setting?
   c. Can permission to use copyrighted materials be obtained in this training setting?
   d. In this training setting, what are the lead times involved in obtaining equipment needed for training?

Notes

e. Does this training approach require base support for printing, or for the preparation of slides, audio or video tapes, or other audiovisual materials? If so, has provision been made in planned schedules for the lead times involved?

C. Instructor requirements for this training approach. (See section on Instructional Personnel)

INSTRUCTIONAL DESIGN AND MANAGEMENT

A. Does this training approach have implications for whether the instruction shall be group paced or individually paced? The following list describes a number of kinds of instructional design:

- Group/lock step: Students receive instruction in groups and all members of a group progress at a scheduled rate.
- Group pacing: Students progress through the instruction at a rate determined by the abilities of the group as a whole. Groups of homogeneous ability levels may be formed (multiple tracks).
- Diagnostic proficiency individualization (modular scheduling): Students are tested to determine whether they need to study sections of the training content and may skip any training content that their test performance shows they have mastered.
- Remedial individualization: Students can study extra training material designed to help them make up for deficiencies in their preparation.
- Supplementary individualization: Students are allowed to work on more than one block of a course at one time. This may include outside study assignments.
- Rate individualization (self-pacing): Students may proceed at their own pace through the required training materials.
- Alternative methods or media individualization (multi-media instruction): Students have a choice (at least part of the time) as to the methods or media they use in studying the training content.

Notes

e. Is support for printing, or for the preparation of slides, audio or video tapes, or other audiovisual materials available in this training setting? With what lead times?

C. Instructor availability in this training setting. (See section on Instructional Personnel)

INSTRUCTIONAL DESIGN AND MANAGEMENT

A. What are the policies in this training setting concerning whether instruction should be group paced or individually paced? Do the kinds of instructional material available or prescribed for use in the instruction have implications for the design of the instruction? The following list describes a number of kinds of instructional design:

- Group/lock step: Students receive instruction in groups and all members of a group progress at a scheduled rate.
- Group pacing: Students progress through the instruction at a rate determined by the abilities of the group as a whole. Groups of homogeneous ability levels may be formed (multiple tracks).
- Diagnostic proficiency individualization (modular scheduling): Students are tested to determine whether they need to study sections of the training content and may skip any training content that their test perfo-mance shows they have mastered.
- Remedial individualization: Students can study extra training material designed to help them make up for deficiencies in their preparation
- Supplementary individualization: Students are allowed to work on more than one block of a course at one time. This may include outside study assignments.
- Rate individualization (self-pacing): Students may proceed at their own pace through the required training materials.
- Alternative methods or media individualization (multi-media instruction): Students have a choice (at least part of the time) as to the methods or media they use in studying the training content.

Notes

B. Does this training approach indicate that a fixed, standard level of skill or proficiency is expected of graduates of the instruction, or that each student is expected to develop his capabilities as far as he can, and in areas at least partly determined by his own interests?

C. Does this training approach make provision for, or have any implications for the provision of management information? The following list indicates some of the kinds of management information that might be involved:

- Information on students' backgrounds
- Information on students' progress through the course of instruction
- Information on the adequacy of various parts of the course of training
- Information on the adequacy of graduates' performance
- Information on instructional resource utilization
-
-

CHARACTERISTICS OF TRAINING CONTENT

A. Is this training approach suitable for the kinds of student performances that can accomplish the training objectives? The following list of kinds of student performances can be considered when evaluating whether this training approach is suitable (any additional types or terms needed to describe the kinds of performances specified by the training objectives should be used also):

- Recall and application of facts
  - Remembering the terminology of an equipment system and the names and locations of the controls so that the student can speak or write with reasonable fluency concerning the system
  - Making specific control settings
- Serial procedures
  - Fixed
    - Energizing electronic equipment
    - Crew drill in a weapons system
  - Variable, or branching
    - Troubleshooting complex equipment using proceduralized methods and job aids
    - Emergency procedures, which often involve branching away from otherwise fixed procedures.

Notes

B. Do the policies in this training setting indicate that a fixed, standard level of skill or proficiency is expected of graduates of the instruction, or that each student is expected to develop his capabilities as far as he can, and in areas at least partly determined by his own interests?

C. Does this training setting require that various kinds of management information be generated, summarized, and reported? The following list indicates some of the kinds of management information that might be required:

- Information on students' backgrounds
- Information on students' progress through the course of instruction.
- Information on the adequacy of various parts of the course of training
- Information on the adequacy of graduates' performance
- Information on instructional resource utilization
-
-

CHARACTERISTICS OF TRAINING CONTENT

A. What kinds of student performances are needed in order to accomplish the training objectives? The following list may be useful in describing these kinds of performances (any additional types or terms needed to describe the kinds of performances specified by the training objectives should be used also):

- Recall and application of facts
  - Remembering the terminology of an equipment system and the names and locations of the controls so that the student can speak or write with reasonable fluency concerning the system
  - Making specific control settings
- Serial procedures
  - Fixed
    - Energizing electronic equipment
    - Crew drill in a weapons system
  - Variable, or branching
    - Troubleshooting complex equipment using proceduralized methods and job aids
    - Emergency procedures, which often involve branching away from otherwise fixed procedures

Notes

- Tracking and aiming
  - Radar tracking
  - Aiming a gun
- Searching and scanning
  - Aircraft detection
  - Aerial observation
  - Scanning—quick search, subordinate to some other task, such as scanning instrument panel while driving.
- Discrete or continuous performance
  - Discrete—step-by-step performance, with individual steps being clearly separate elements of the performance
    - Operating control panels in missile systems
    - Assembly and disassembly of equipment
  - Continuous—cannot be divided into clearly separate elements; continuing performance, usually guided and modulated by feedback.
    - Aligning or adjusting electronic equipment
    - Riding a bicycle
- Noise-filtering—detecting cues or symptoms among a background of extraneous simulation
  - Listening to an engine to diagnose malfunctions
  - Detection of targets on radar scope
- Skilled actions—activities that the untrained person cannot perform satisfactorily, even if he is told what to do
  - Clutching and shifting an automobile with a manual transmission
  - Precision measurement with a micrometer
- Discrimination behavior—recognizing differences between objects, indications, or examples so that different responses can be made to them
  - Aircraft, tank, or automobile identification
  - Selecting one answer, example or object (solder joint, for example) as the "best" or "correct" one, according to certain standards.
- Complex perceptual-motor behavior
  - Driving a car
  - Flying an airplane
- Problem-solving—recall and application of concepts and principles
  - Troubleshooting complex equipment without proceduralized methods and job aids
  - Planning the work of a group of people and assigning tasks

Notes

- Tracking and aiming
  - Radar tracking
  - Aiming a gun
- Searching and scanning
  - Aircraft detection
  - Aerial observation
  - Scanning—quick search, subordinate to some other task, such as scanning instrument panel while driving
- Discrete or continuous performance
  - Discrete—step-by-step performance, with individual steps being clearly separate elements of the performance
    - Operating control panels in missile systems
    - Assembly and disassembly of equipment
  - Continuous—cannot be divided into clearly separate elements; continuing performance, usually guided and modulated by feedback
    - Aligning or adjusting electronic equipment
    - Riding a bicycle
- Noise-filtering—detecting cues or symptoms among a background of extraneous stimulation
  - Listening to an engine to diagnose malfunctions
  - Detection of targets on radar scope
- Skilled actions—activities that the untrained person cannot perform satisfactorily, even if he is told what to do
  - Clutching and shifting an automobile with a manual transmission
  - Precision measurement with a micrometer
- Discrimination behavior—recognizing differences between objects, indications, or examples so that different responses can be made to them
  - Aircraft, tank, or automobile identification
  - Selecting one answer, example or object (solder joint, for example) as the "best" or "correct" one, according to certain standards
- Complex perceptual-motor behavior
  - Driving a car
  - Flying an airplane
- Problem-solving—recall and application of concepts and principles
  - Troubleshooting complex equipment without proceduralized methods and job aids
  - Planning the work of a group of people and assigning tasks

Notes

B. Is this training approach suitable, considering the degree of proficiency required in the various tasks or performances that the student will be expected to accomplish to satisfy the training objectives? The following outline describes the kinds and levels of proficiency that might be required:

- Task performance standards
  - Extremely limited—can do simple parts of the tasks but needs to be told or shown how to do most of the task
  - Partially proficient—can do most parts of the tasks but needs help on the hardest parts of the tasks
  - Competent—can do all parts of the tasks and needs only be spot-checked
  - Highly proficient—can do complete tasks quickly and accurately and can tell or show others how to do the tasks
- Task knowledge standards
  - Nomenclature only—can name parts, tools, and simple facts about the tasks
  - Procedures—can name the steps in doing the tasks and tell how each is done
  - Operating principles—can explain why and when tasks must be done and why each step of a task is needed
  - Complete theory—can predict, identify, and resolve problems about the tasks
- General knowledge standards
  - Facts—can cite basic facts about the subject
  - Principles—can explain relationships among basic facts and state general principles about the subject
  - Analysis—can analyze facts and principles and draw conclusions about the subject
  - Evaluation—can evaluate conditions and make proper decisions about the subject

C. Implications (or requirements) of training approach for organization of training content.

1. Does this training approach provide a basis for dividing the training content into blocks or modules?

Notes

B. What kinds and levels of proficiency are required of students in performing the various tasks they must do to satisfy the training objectives? The following outline describes the kinds and levels of proficiency that might be required:

- Task performance standards
  - Extremely limited—can do simple parts of the tasks but needs to be told or shown how to do most of the task
  - Partially proficient—can do most parts of the tasks but needs help on the hardest parts of the tasks
  - Competent—can do all parts of the tasks and needs only be spot-checked
  - Highly proficient—can do complete tasks quickly and accurately and can tell or show others how to do the tasks
- Task knowledge standards
  - Nomenclature only—can name parts, tools, and simple facts about the tasks
  - Procedures-can name the steps in doing the tasks and tell how each is done
  - Operating principles—can explain why and when tasks must be done and why each step of a task is needed
  - Complete theory—can predict, identify, and resolve problems about the tasks
- General knowledge standards
  - Facts—can cite basic facts about the subject
  - Principles—can explain relationships among basic facts and state general principles about the subject
  - Analysis—can analyze facts and principles and draw conclusions about the subject
  - Evaluation—can evaluate conditions and make proper decisions about the subject

C. Factors in the training setting that influence the organization of training content.

1. Are there, within the training content itself, natural divisions that should be considered when dividing the training content into blocks or modules? Are some parts of the training content prerequisite to other parts?

Notes

2. Does the training approach have any implications for the sequencing of training content?

D. What kinds of instructional activities are implied by the training approach? The following list gives several examples of kinds of instructional activities (others should be added if they are needed):

- Presentation of knowledge
- Practice of knowledge
- Practice of performance
- Demonstration
- Provision of feedback, or knowledge of results, to students
- Provision of individual, tutorial assistance to students
- Evaluation, or training quality control
-
-

E. What effect does this training approach have on the effort necessary to make changes in the training content? In answering this question it may be useful to consider the kinds of units or modules of content involved in this training approach, and the formats or media to be used.

INSTRUCTIONAL PERSONNEL

A. What roles do instructors play in this training approach? The following list describes some possible roles for instructors; others should be added if necessary:

- Presentation of instruction (lecturing, demonstrating)
- Evaluation of student performance (proficiency testing)
- Monitoring student performance (and intervening when necessary)

Notes

2. Are there other factors in the training setting that should be considered when dividing the training content into blocks or modules and deciding on the sequence of training activities? Some of these factors might be:
   - Availability or arrangement of physical facilities, such as operational or training equipment
   - The need for a flexible sequence of training activities, in order to be able to work around bad weather or equipment failures
   - Command policies

D. What kinds of instructional activities are implied by the training content (and possibly by other aspects of the training setting)? The following list gives several examples of kinds of instructional activities (others should be added if they are needed):
- Presentation of knowledge
- Practice of knowledge
- Practice of performance
- Demonstration
- Provision of feedback, or knowledge of results, to students
- Provision of individual, tutorial assistance to students
- Evaluation, or training quality control
-
-

E. What are the frequency and extent of training content changes that may be expected in this training setting? What are the policies regarding changes in training content in this training setting?

INSTRUCTIONAL PERSONNEL

A. Does the training content, or any other aspect of the training setting, have implications for the roles to be played by instructors? The following list describes some possible roles for instructors; others should be added if necessary:
- Presentation of instruction (lecturing, demonstrating)
- Evaluation of student performance (proficiency testing)
- Monitoring student performance (and intervening when necessary)

Notes

- Managing the instructional system (assigning students to training activities, monitoring training equipment utilization, etc.)
- Planning and developing instruction (ISD activities)
- Conducting discussions
- Leading student activities
-
-

B. Are auxiliary instructional personnel needed with this training approach? The following list describes some possible kinds of auxiliary instructional personnel; other kinds should be added if needed:

- Proctors (monitoring student activities but not intervening)
- Administrative clerks (recording and processing data)
- Training equipment operators and repairmen
- Computer programmers
-
-

C. What special skills are needed by instructors using this training approach? The following list describes some possible kinds of special skills that might be required; other kinds should be added if needed:

- Proficiency in the subject matter students are to learn
- Managing instructor-student relationships (classroom management skills, reinforcement techniques, counselling techniques, etc.)
- Analyzing and critiquing student performance
- Relevant field experience
- Proficiency in instructional system development activities
- Operation of audio-visual equipment
- Computer operation or programming
- Writing skills
- Proficiency in evaluating student performance
- Knowledge of the relevant administrative system
- Operation and/or maintenance of operational equipment
-
-

Notes

- Managing the instructional system (assigning students to training activities, monitoring training equipment utilization, etc.)
- Planning and developing instruction (ISD activities)
- Conducting discussions
- Leading student activities
-
-

B. Are auxiliary instructional personnel available in this training setting? The following list describes some possible kinds of auxiliary instructional personnel; other kinds should be added if needed:

- Proctors (monitoring student activities but not intervening)
- Administrative clerks (recording and processing data)
- Training equipment operators and repairmen
- Computer programmers
-
-

C. What special skills are possessed by the instructors available or obtainable in this training setting? The following list describes some special skills that might be available; other kinds should be added if needed:

- Proficiency in the subject matter students are to learn
- Managing instructor-student relationships (classroom management skills, reinforcement techniques, counselling techniques, etc.)
- Analyzing and critiquing student performance
- Relevant field experience
- Proficiency in instructional system development activities
- Operation of audio-visual equipment
- Computer operation or programming
- Writing skills
- Proficiency in evaluating student performance
- Knowledge of the relevant administrative system
- Operation and/or maintenance of operational equipment
-
-

Notes

D. Instructional personnel management.

1. Considering the relevant Trained Personnel Requirement (TPR) and the skills of the instructors available, will this training approach require more or fewer instructors than would otherwise be needed? Does this training approach require some minimum number of instructors to be feasible?
2. If the number of students is increased or decreased substantially, will additional or fewer instructors be required for this training approach? If so, in what ratio to the increased or decreased number of students?
3. If additional instructors will be needed for implementing this training approach, have allowances been made in planning for the lead time necessary to obtain these instructors?
4. Is special or additional training required for instructors to use this training approach? The resistance to change found in almost all organizations may be a special problem in implementing a new training approach.
5. Does this training approach have any special implications for evaluating instructors? Are some instructor performances particularly critical in this training approach? Are indicators of instructor performance available with this training approach?

STUDENT CHARACTERISTICS

A. Numbers of students.

1. Is this training approach feasible for the numbers of students that must be trained? Does this training approach require a minimum number of students to be feasible?
2. Does this training approach deal with students in groups, or can it accommodate a more or less continual flow of students into the training course?
3. Can this training approach handle marked fluctuations in the numbers of students entering training?

Notes

D. Instructional personnel management.

1. In this training setting, how many instructors are normally authorized for the expected numbers of students in this course or portion of a course?

2. If the number of students is increased or decreased substantially, will the authorized number of instructors be adjusted accordingly in this training setting? If so, in what ratio to the increased or decreased number of students?

3. In this training setting, what is the lead time involved in obtaining additional instructors?

4. Are facilities or resources available in this training setting so that any requirements for special or additional training of instructors can be met?

5. What are the policies regarding instructor evaluation in this training setting?

STUDENT CHARACTERISTICS

A. Numbers of students.

1. According to the relevant Trained Personnel Requirement (TPR), how many students per week, month, or year are required to be trained in the course or part of a course concerned?

2. In this training setting, are students available to begin training in groups at specified intervals, or in a more or less continual flow?

3. Does the number of students available to enter training fluctuate sharply?

Notes

4. Does this training approach utilize a basic instructional group of relatively fixed size (e.g., classroom, work, or laboratory group), so that there is a relatively fixed increment by which the number of students in training can be increased or decreased?

B. Relationship of training approach to student aptitude levels.

1. Is this training approach especially suitable for students within a particular range of the relevant aptitudes—high, low, or middle—or is it useful for students of all aptitude levels?
2. Is this training approach suitable for students selected for any special aptitudes other than the four standard Air Force aptitude areas (Administrative, Electronics, General, and Mechanical), such as athletic, verbal, clerical, or space relations?

C. Special skills or other characteristics required of students by this training approach.

1. Does this training approach assume that entering students will already have been trained in any special skills?
2. Must students have some minimum reading level for this training approach to be feasible?
3. Does this training approach require that students have especially good vision, hearing, or other senses? What about students with poor sensory acuity, especially those who are more or less color-blind?
4. Does this training approach have any implications or requirements for other student characteristics; such as physical stamina, fear of heights, volunteer vs. non-volunteer, Human Reliability, speech impediments, manual dexterity, appearance and bearing, etc.?
5. Can this training approach accommodate students who are unusually strong (or weak), or large (or small)?

Notes

4. Do student input rates, or the characteristics of the physical facilities in this training setting have implications for the size of the basic instructional group (e.g., classroom, work, or laboratory group), and in turn, for the size of increases or decreases of the number of students in training?

B. Aptitude levels of students in this training setting.

1. Are the students available or assigned to this training setting selected so that they fall within a particular range on the relevant aptitudes—high, middle, or low—or are they of all levels of aptitude?

2. Are the students available or assigned to this training setting selected for any special aptitudes other than the four standard Air Force Aptitude areas (Administrative, Electronics, General, and Mechanical), such as athletic, verbal, clerical or space relations?

C. Special skills or characteristics possessed by students in this training setting.

1. Have students in this training setting already been trained in any special skills?

2. What is the reading level of students in this training setting?

3. Have students in this training setting been selected for especially good vision, hearing, or other sensory acuities? Or, do some students have poor sensory acuity, such as defective color vision?

4. Do the students in this training setting need to have any other characteristics that might be relevant, such as physical stamina, lack of fear of heights, volunteer vs. nonvolunteer, Human Reliability, no speech impediments, manual dexterity, particularly good appearance and bearing, etc.?

5. Are the students in this training setting unusually strong (or weak), or large (or small)?

Notes

D. Does this training approach have any implications for the sex of students, or for whether students are dealt with in sexually mixed or segregated groups? Factors that might be involved here include: different equipment or clothing requirements for women from men, or from those normally used by women; latrine facilities; quarters; etc.

E. Does this training approach have any implications concerning whether foreign students, or students from other services are involved in the training?

F. Does this training approach have any provisions for dealing with students who may be very poorly motivated because of malassignment or for other reasons?

G. Implications of training approach for student management.

1. Will it make any difference in using this training approach whether the course of instruction is of fixed or variable length for different students?
2. If this training approach is used, will information be available from which to predict students' dates of availability for assignment (graduation), if a variable length course of instruction is used?
3. Will use of this training approach make it necessary (or possible) for students to have periods of time before, during, or after the main body of training when they will not be occupied with training activities? If so, and students are not required to perform details or other activities not related to training, does this training approach suggest constructive uses for this time?
4. Can this training approach accommodate student absences from training activities, and the resulting need to make up missed work?

Notes

D. Are the students in this training setting male or female, or both? If both sexes are represented, are there any policies or implications from the training setting as to whether groups of students shall be sexually mixed or segregated? Factors that might be involved here include: different equipment or clothing requirements for women from men, or from those normally used by women; latrine facilities; quarters; etc.

E. Are there foreign students, or students from other services represented among the students in this training setting?

F. Is it likely in this training setting that any significant number of students will be encountered who are very poorly motivated because of malassignment or for other reasons? Are there policies which indicate how such students are to be dealt with?

G. Policies affecting student management in this training setting.

1. Does the training setting require a fixed length for the course of instruction, or is a course of instruction of variable lengths for different students permitted?
2. What requirements for advance information on students' dates of availability for assignment (graduation) does this training setting impose, if a variable length course of instruction is used?
3. Are students in this training setting required to perform extra duties, details, etc., not related to training, or is it important for them to finish training as soon as possible? Is it possible to offer incentives to students who finish training early?
4. How much may students be expected to be absent from training activities in this training setting?

Chapter 5

DISCUSSION OF THE MODEL

During the development of the model, a number of difficulties and tempting diversions were encountered. These are discussed in the following section. Also, in a later section of this chapter, the relationships of this model to several major systems and projects involving Air Force technical training are discussed.

COMMENTS ON THE MODEL

Trying to capture as many as possible of the significant factors in the training universe within the two categories, training approaches and training settings, has been difficult. A sustained effort was made, in developing the model, to keep its purpose in a dominant, governing position. In shaping the questions for the model so that they tap significant factors in the training situation, there has been a strong tendency for some elements in the training setting—particularly training content—to assume the status of additional, independent categories. In fact, a description of the training universe merely for the sake of description might have led to several major elements having coordinate status—training approaches, students, instructors, training content, physical facilities of the training establishment, and so forth. However, because the purpose of the model is to evaluate the potential suitability and usefulness of training approaches in particular training settings, the model has been cast in the form of these two categories.

In the course of developing the model, there has also been a tendency to think of the training approach as generating requirements in the training situation, and to feel that an examination of the training setting can show whether, or to what extent, these requirements may be satisfied. It was found, however, that this conceptualization of requirements vs. resources with which to satisfy them was not particularly useful or valid, because requirements also arose out of elements in the training setting, particularly the training content and the policies of the training agency or command. This way of looking at the problem was set aside in favor of the training approach/training setting conceptualization.

In developing the parts of the model dealing with instructional personnel, account was taken of the work of Melching and Whitmore (1973) on the requirements for effective performance by Army instructors in classroom teaching. Their model of the functions of a master instructor covers a limited area of performance, and accordingly is much more detailed in the area of instructor performance than the model described in this report. However, the instructional personnel sections of this model are designed to be consistent with the Melching and Whitmore model.

The classification of the kinds of performances required of students by the training objectives, under "Characteristics of Training Content" in the model, has been a difficult area to deal with. Clearly, the kinds of performances expected of students after training should determine the kinds of activities in which they engage during training. The nature of these learning activities is important in determining whether training approaches (i.e., any methods, techniques, devices, or systems being considered for use in training) are appropriate and effective. It also has important implications for many other elements of

the training setting, such as the amount and kind of space required, the skills required of instructors, and the aptitudes and previous training required of students.

However, in the MODIA system (Bretz, 1972, p. 5), any classification of the training content is strictly avoided. Individuals responding to the MODIA curriculum analysis questionnaire must infer from the nature of the training content with which they are dealing, to make decisions about whether the training will be in a classroom, whether special equipment is needed, whether individual or interactive skills are involved, whether this learning event requires visual means (besides print), sound, or motion, and so forth. In general, the nature of the activities occurring in a "learning event" is not explicitly considered in MODIA, and the instructional designer who responds to the curriculum analysis questionnaire is required to examine these activities and make inferences from them with no guidance from any conceptualization of the kinds of student performances being dealt with.

In the model described in this report, an attempt was made to provide analysts with a frame of reference for the performances required of students, to aid them in inferring from these performances the appropriateness or probable effectiveness of the training approaches being considered. In developing the classification of the kinds of performance required of students in the "Characteristics of Training Content" section of the model, several previous efforts at classifying human performance were studied, primarily those in Bloom (1956), Gagne (1970), and Fleishman and Stephenson (1970).[1] The systematic approach to training of Smith (1971) was also consulted.

It was concluded that comprehensive classifications of human performance have been difficult to develop and are of limited usefulness. In developing the classification of the kinds of performances required of students for this model, considerable use was made of Gagne's (1970) eight types of learning and of Bloom's *Taxonomy of Educational Objectives* (1956). However, the attempt was made to describe the kinds of performances listed in the classification in terms that were more relevant to Air Force technical training content than the descriptions of performances offered by Gagne and Bloom.

This classification of the kinds of performances required of students has a good deal in common with the types of learning discussed in AFM 50-2 (Department of the Air Force, 1970, pp. 5-12, 5-13), and in AFP 50-58 (Department of the Air Force, 1973, Chapter 3), which were undoubtedly derived from much the same sources. It is not considered crucial whether the classification described above, or one of those described in AFM 50-2 or AFP 50-58, is used in this model. It is considered important that the instructional designer be given some guidance in deriving the implications of type of training content for training approaches.

The kind of performance labeled "recall and application of facts" is the same as the behavior called "rule learning" by Gagne (1970). In this kind of behavior, concepts and their relationships (rules) must have been learned, and their applicability recognized, in order for the behavior to be possible in a specific situation. Thus, to follow the rule "always pour acid into water, and not water into acid, when mixing the two substances," the student must have learned the concepts "acid" and "water" and the relationships "pouring" and "mixing." Or, to follow the rule or prescription "set the voltage at 115, ± 5," the student must have learned the concepts "voltage" (at least to the extent of knowing which control to operate), "115, ± 5" (at least to the extent of knowing which indicator to observe and the range denoted), and the relationship "to set."

It should also be noted that "discrimination behavior" is intended to cover evaluation and recognition behaviors, since an awareness of differences between stimuli (objects,

[1] This project extended over several years and resulted in numerous technical reports. The specific report cited was chosen because it gives a good overview of the project and lists the project reports.

indications, or examples) and the use of some standard or rule to select differential responses to the stimuli are common to all such behavior. Thus, the student may recognize that traffic lights are of different colors (or that the red light is on top, and the green light is the bottom one) and stop if the red light is illuminated or proceed if the green light is illuminated. Or, the student may recognize differences among a set of radio or intercom messages and choose one to label as most appropriate or correct according to a specified rule or standard.

Finally, a performance may involve more than one element of this classification. Thus, serial procedures are often discrete performances and continuous performances are usually skilled actions, of which an example might be tracking performance. Thus, a radar operator's job may involve several of these elements: fixed serial procedures in energizing the equipment; noise-filtering, in observing the radar presentation; and continuous performance in tracking. The purpose of such a classification is to make more obvious the different aspects of a job or even a specific performance within a job, so that suitable activities may be selected or devised for students to engage in during training.

Some thought was given to casting the model in the form of two coordinated checklists by developing comprehensive sets of answers to the questions, so that using the model would involve responding to a series of multiple-choice questions. However, it was felt that, at the present stage of model development, it would be difficult to develop sets of choices comprehensive enough to adequately cover the great variety of possible answers to the questions asked about training approaches and settings. (For example, how many and what kinds of special skills might conceivably be required of students as prerequisites for entering many different courses of study?) Comprehensive tabulation of a long list of possibilities here would be very difficult. Therefore, it was decided, for the present at least, to cast the model in the more general form of open-ended questions, and to rely on the analyst using it to generate, in response to the questions, the specific characteristics or attributes appropriate to a particular training approach and training setting.

The model in its present form of two coordinated series of open-ended questions is not immediately amenable to computerization. After the model as it now stands has been tested for its adequacy and usefulness and revised as necessary, and if it appears that a substantial volume of usage can be expected, it should be possible to modify it for use with a computer.

One possible approach to computerizing the model would be to cast it in the form of two coordinated checklists, as has been discussed. It could be set up to operate in an interactive fashion similar to that planned for the MODIA system for designing instructional programs (Carpenter, 1972). Computer software might be developed for presenting the questions and sets of answers to the analyst at a computer terminal, recording the answer choices, and summarizing the degree of "fit" between the training approach and the training setting. A substantial effort would be required to develop the software necessary for computerizing the model, and it is felt that its adequacy should be evaluated and estimates of its likely volume of usage obtained before making a decision on whether to computerize the model.

RELATIONSHIP OF MODEL TO ISD, AIS, AND MODIA

A number of major programs are in various stages of implementation in the U.S. Air Force technical training environment. Most important of these are the Instructional System Development (ISD) effort (Department of the Air Force, 1970, 1973), the Advanced Instructional System (AIS) effort (Rockway and Yasutake, 1973), and the MODIA system (Carpenter, 1972; Carpenter and Horner, 1972; Bretz, 1972; and

Petruschell and Carpenter, 1972). This section will discuss the relationship of the model presented in this report to these major programs or systems. Generally, it is expected that this model should be useful within the frameworks of all of these programs or systems.

The ISD effort is a large, Air Force-wide program in which the major training innovations of the 1950s and 1960s are being implemented. The model for matching training approaches with training settings should be useful primarily in connection with the activities of Step 4 of the ISD process—Plan, Develop, and Validate Instruction. It is not expected that the model would be used formally for every decision made in the course of Step 4 activities in the ISD process, although many of the factors in the model might be informally weighed in making these decisions. However, whenever any substantial decisions concerning instructional methods, techniques, media, or devices are to be made, the model should be useful. It would probably be useful also in making decisions concerning testing methods and devices in Step 3 of the ISD process.

It should be emphasized that the model is designed for a much broader scope of usefulness than the relatively narrow area of instructional media selection. The application of the model during development to some basic instructional system techniques, such as peer instruction and mastery testing, for example, and to sophisticated instructional devices such as the Lincoln Training System, should demonstrate the wide applicability of the model.

The AIS is a computer-based system for the administration and management of individualized technical training on a large scale, presently being developed at Lowry Air Force Base. The system is to encompass the whole range of instructional activities from the development of instructional materials and strategies to the administration and evaluation of instruction involving a variety of media and methods. After the development and demonstration of the system on three courses at Lowry Air Force Base, it is likely that it will be expanded and installed at other locations so that a substantial part, perhaps most, of Air Force technical training may be carried out within such systems some years hence.

In terms of the definitions set out early in this report, the AIS, along with a given body of training content, may be considered a training setting. Because of its probable importance in Air Force technical training in the near future, it is likely to be the single most important training setting to which the model described in this report might be applied.

Within the general framework of the AIS, as it is used for additional courses and at additional locations, there will be a large number of decisions to be made concerning what this report has called instructional approaches; strategies and methods of instruction, instructional devices, job aids, and so on. The general model developed in this project could be adapted for use in the AIS by describing the main characteristics of the AIS as a training setting. Then the characteristics of a particular training content could be added, and one would have a very substantial set of requirements and standards, against which to evaluate any training approach which one might wish to consider. Thus the model described in this report is seen as quite capable of being incorporated into the AIS as an aid in its expansion and installation at other locations.

The MODIA system has been developed for the U.S. Air Force by the Rand Corporation (in a project entitled "Analysis of Systems for Air Force Education and Training"). MODIA (A Method of Designing Instructional Alternatives) is a comprehensive methodology for designing instructional programs.

The greatest strength of the MODIA system is its capabilities for spelling out in detail the consequences and costs of a given set of decisions concerning an instructional program. Also, in its computerized form, it will make possible the ready comparison of the consequences and costs of alternative decisions concerning an instructional program.

However, the MODIA system has been designed to be almost universally applicable, and this has led to the use of a highly generalized and somewhat abstract terminology. It is likely that this terminology will be confusing to many Air Force training personnel who have become thoroughly familiar with Air Force, and particularly, Air Training Command concepts and regulations. Further, the MODIA system is relatively weak in the guidance it offers to instructional planners to help them make the major, early decisions in designing an instructional program. The MODIA techniques for bringing to bear on the instructional design process the policies and constraints of the training command or agency and the implications of the particular training content involved depend on highly detailed, branching questionnaires. The detailed choices posed in these questionnaires are inevitably highly structured and tend to limit the conceptualization of the instructional process. In addition, they are often highly abstract. In short, it is argued that in the area of major decisions concerning training approaches which must be made early in the instructional design process, the MODIA system is limited in its scope and flexibility, and in the guidance it offers to instructional planners. In an earlier part of this Chapter, this point has already been made in more detail in the discussion of the implications of the kinds of performances required of students (i.e., training content) for decisions regarding training approaches.

The model described in this report, by virtue of its flexible, open-ended nature, and the fact that it concentrates entirely on the implications of all aspects of the training setting for these major, early decisions regarding training approaches, should handle this part of the instructional design process more adequately than the MODIA system does. Once these major, early decisions regarding training approaches have been made, the MODIA system for spelling out in detail their consequences and costs should be quite useful.

Chapter 6

APPLICATIONS OF THE MODEL

The current version of the model for matching training approaches with training settings has been applied to a training approach and to a training setting. The application to the training approach was made by the project principal investigator and author of this report, while the application to the training setting was made by the other member of the research team that visited the Technical Training Centers, as described in Chapter 3.

APPLICATION TO TRAINING APPROACH

The training approach to which the model was applied was the peer instruction system (Weingarten, Hungerland, and Brennan, 1972). In this case, both the peer instruction and the mastery testing training approaches, as described in Chapter 2 of this report, are included, since operational peer instruction systems have included both features.

In applying the model to the peer instruction system, it was found that, in almost all cases, the questions on the training approach side of the model could be answered quite readily. Somewhat general answers had to be given to some questions, and in a few cases information from a specific training setting would have been required to answer the question. This application is at the general, preliminary level described in the introduction to the model in Chapter 4, for which the model appears quite feasible. This application of the model to the peer instruction training approach is presented in Appendix A to this report.

APPLICATION TO TRAINING SETTING

The training setting to which the model was applied was that of Course No. 3ABR81230, Law Enforcement Specialist, as taught at Lackland Air Force Base, Texas. The information available on which to base this application of the model consisted of the Course Chart and the Plan of Instruction (POI) for the course, plus the general information gained during the visit of the research team to the School of Applied Aerospace Sciences at Lackland Air Force Base.

It was found that, while a number of questions on the training setting side of the model could be answered, many critical ones could not be answered with the information available. For example, the question on "Objectives" probes in a general fashion for the hopes and aspirations of persons working in the training setting who are responsible for its effective and efficient operation, and for problems that may exist within the training setting. It was not possible to answer this question in any substantive fashion.

Most of the questions concerning the availability of space, equipment, and support services of various kinds, and the lead times required, could not be answered very well, and those that could be were answered only in terms of the kinds of space and

equipment being used in the current course. From the documentation and the brief visit of the research team, almost no information was obtained on the kinds of equipment, space, and support services that might be available to the School if they were needed.

Likewise, the questions in the "Instructional Design and Management" section of the course could be answered only by inferences from the course as currently taught; information on the broader framework of policies within which the School operates was not available without extended immersion in USAF and ATC directives and regulations. Finally, the documentation provided no information about the characteristics of students taught in the course, and the impressions obtained during the brief visit of the research team were considered wholly inadequate as a basis for answering the questions in this section of the model.

It is clear that this model cannot be applied very successfully to a training setting *at a distance* and with documentation intended for other uses, as in this case. A wide variety of information is needed to answer the questions on the training setting side of the model. If detailed and specific answers to the questions are sought in a secondary analysis, as described in the introduction to the model in Chapter 4, information will probably have to be obtained from a variety of sources, including agencies having responsibility for the controller, civil engineering, and personnel management functions, as well as from knowledgeable personnel both at the instructional department level and at higher command levels.

Questions concerning the availability of funds in this training setting could not be answered for two reasons—the lack of information, and the fact that these questions involved consideration of a specific training approach. Questions concerning the availability of space and equipment also involve to some extent the training approach being considered. Applying the model to a training setting without having a specific training approach under consideration leads to inventorying the training setting on several different dimensions that the questions involve: resources, nature of training content, personnel (both students and instructors), and general policies. While this may be worthwhile, it is likely to be a demanding task. If a specific training approach is under consideration, the scope of the answers to the questions about the training setting can be markedly reduced, so that the only information sought is that necessary to evaluate the training approach for possible use in this training setting.

It was found that the questions concerning the characteristics of the training content in this training setting could be answered fairly readily, but even here a difficulty developed. Because the training or criterion objectives were clearly set out in the Plan of Instruction, it appeared natural and straightforward to use these objectives as the units for describing the kinds of student performances needed in the training. However, there were 106 objectives listed in the Plan of Instruction, and the effort to describe the kind of student performance implied by each of them degenerated into a tedious and repetitive analysis. Dividing the training content into somewhat fewer and larger units would probably lead to a more satisfactory analysis.

This application of the model to a training setting contributed information on which a number of changes in the model were based. These changes, mainly in the section on "Characteristics of Training Content," were of two kinds: (a) changes to bring some questions more closely in line with Air Training Command nomenclature, so that the model will be easier for training managers and planners at the Technical Training Centers to use; and (b) additional categories in some of the classifications presented in the model

to aid in answering the questions. These changes have been made in the current version of the model, as it is presented in this report.

Since this application of the model to a training setting was not very satisfactory, it is not presented in an appendix.

In a continuation of this work,[1] it is planned to apply the model to a training setting (as well as to a training approach) in close collaboration with Air Force personnel in a Technical Training Center. In this application it should be possible to obtain the information that was lacking in the application described above, and the application will also involve a specific training approach. Therefore, a thorough and rigorous evaluation of the model should be possible.

[1] U.S. Air Force Office of Scientific Research Contract No. F44620-74-C-0007, Basic Research Relevant to U.S. Air Force Technical Training: Application and Evaluation of a Model for Matching Training Approaches With Training Settings in an Actual Instructional Situation.

Chapter 7

CONCLUSIONS AND IMPLICATIONS

PRESENT STATUS OF MODEL

The model for matching training approaches with training settings presented earlier in this report is a second generation model. After its initial development, it was taken to the field at Air Force Technical Training Centers where it was exposed to the criticism of the Air Force training managers and designers for whose use it was constructed. This criticism supported the general approach of using two coordinated sets of questions, one dealing with the training approach and one with the training setting, and the kinds of questions that had been included in the original version of the model. Many additional questions were suggested and have been included in the current version of the model, and the primary thrust of the model has been shifted to questions dealing with training costs and resources.

The current version of the model has been applied to a training approach and to a training setting. The application to the peer instruction training approach was quite successful, but the application to the training setting of the Law Enforcement Specialist course at Lackland Air Force Base was much less so—primarily because the documentation and other information available was inadequate for answering many of the questions on the training setting side of the model. This difficulty can almost certainly be overcome by working more closely with Air Force training managers and designers in the training setting.

During these applications of the model to both the training approach and the training setting, it became apparent that a few questions concerning the training approach could not be answered adequately without information on a specific training setting, and that several questions concerning the training setting could not be answered very well unless one was considering a specific training approach for use in that training setting. This partial interdependence of the training approach and training setting sides of the model is of no consequence if it is being used to evaluate a training approach in relation to the requirements of a training setting. It may create some problems if the model is being used to describe a training approach, or to inventory the characteristics and resources of a training setting, independently. Whether the model should be revised so that the training approach and training setting parts may be used fully, each independently of the other, or whether this interdependence is desirable, depends on the kinds of applications for which the model is found to be most useful. Further experience with the model is necessary to resolve this question.

PLANS FOR CONTINUING WORK WITH THE MODEL

In work that is just beginning, it is planned to apply the model at two levels, working in close collaboration with training managers and designers at an Air Force

Technical Training Center.[1] The peer instruction system (to which the model was applied in Chapter 3) emerged as a training approach that appeared suitable for a demonstration implementation in an Air Force technical training setting, and the research team also found at Air Force Technical Training Centers that the training managers and designers showed interest in that approach. To utilize this interest, and at the same time subject the model to a rigorous empirical evaluation in an operational training situation, it is planned to use the model in the selection of a particular course in which to implement the peer instruction training approach.

The application of the model to the training settings associated with the candidate courses will be carried out in close cooperation with training managers and designers who are working in these training settings. Thus, the information that was lacking in the application of the model to a training setting described in Chapter 6 should be readily available. Furthermore, these applications of the model to training settings will be carried out in relation to the peer instruction training approach, so that it should be possible to answer all questions on the training setting side of the model. These applications of the model to the peer instruction training approach and to a number of training settings will make possible a rigorous evaluation of the usefulness of the model for matching training approaches with training settings.

It is also planned to use the model on a micro-level to analyze in detail the segments or modules into which the selected course will be divided. The purpose of these analyses is to select the specific adaptation of the peer instruction training approach to be used in each module of the course, and to anticipate problems in the development and implementation of the modules of the course. Thus, the use of the model as a general-purpose analytical tool in developing and implementing training approaches in particular training settings will be explored and evaluated.

FUTURE POSSIBILITIES

The approach taken in constructing this model offers the possibility of a standardized method of describing and evaluating training approaches in terms that are clearly relevant to the realities of training settings. The method would be comprehensive, and reflect the day-to-day, down-to-earth concerns of training managers and designers working in military training settings. When training approaches selected by this method are implemented, they should be considerably more likely to produce desirable, hoped-for results than training approaches selected by current methods that are less systematic and comprehensive.

A Center for Evaluating Training Approaches

To make this standardized method for describing and evaluating training approaches available to military training managers and designers, a Center for Evaluating Training Approaches is proposed. The functions of this information center would be to:

(1) Analyze training approaches by applying the model to them.
(2) Make available in standardized formats the results of these analyses of training approaches.

[1] Under a continuation of U.S. Air Force Office of Scientific Research Contract No. F44620-74-C-0007, Basic Research Relevant to U.S. Air Force Technical Training: Application and Evaluation of a Model for Matching Training Approaches with Training Settings in an Actual Instructional Situation.

Training managers and designers would apply the training setting side of the model to their training setting. Thus, the intimate knowledge of their own training setting possessed by training managers and designers would be tapped by this procedure.

The results of the analyses of many training approaches by the Center staff could be made available in a number of ways. One method would be to publish a collection of standardized descriptions of training approaches, which training managers and designers could consult after they had analyzed their training setting to select onè or more training approaches that matched their training setting particularly well. Another method would be to construct a computerized data bank of training approach descriptions and have training managers and designers send the analyses of their training settings to the center so that a comprehensive computerized matching procedure could be carried out.

Such a system would facilitate the selection of training approaches for course development or revision efforts by making possible quick searches covering large numbers of candidate training approaches. Because the model to be used in this selection process is explicitly organized around factors of major importance in real-life military training settings, the selections should be highly valid. Thus, the training approaches selected by these methods should have substantially improved chances for successful implementation. Currently used procedures for selecting training approaches for implementation sometimes suffer from faddism, or bandwagon effects, and a system based on this model would avoid or reduce this problem.

When a training approach selected by these methods has been implemented in a training setting, information on the success of the implementation and any difficulties encountered should be fed back to the Center for Evaluating Training Approaches. Thus, the effectiveness of the selection process and the adequacy of the model can be continually evaluated.

If innovative training approaches are analyzed and entered into such a system as soon as they have been developed and given preliminary evaluations in one training setting, they would be immediately available for consideration and evaluation in many other training settings. The increased validity of the process by which these innovative training approaches would then be selected for implementation in other training settings would make the process of technology transfer and utilization more efficient, by reducing the number of inappropriate efforts to implement innovative training approaches that would be likely to result in failure. Thus, the overall effect of this system would be improved utilization of research on training methods and approaches.

After pilot studies under Air Force auspices, the Center for Evaluating Training Approaches should probably be set up at the Department of Defense level, so that the whole range of military training approaches and settings to which the model and the system would be applicable could be included. Thus, the utilization of training research throughout the military services would be improved.

A Civilian Analogue

The civilian educational system in the United States is in great need of a system for providing better guidance for, and obtaining better utilization of, the substantial volume of educational research and development that has been done in recent years (Comptroller General of the U.S., 1973; Gideonse, 1971). A civilian analogue of the Center for Evaluating Training Approaches just described could contribute to satisfying this need.

The model would need to be revised to orient it around factors of major importance in civilian educational settings, instead of those important in military training settings. A center using this revised model could then provide educational planners and administrators with a capability to rapidly survey and select educational approaches that match the requirements of their educational settings.

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AND

APPENDIX

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Appendix A

APPLICATION OF MODEL TO PEER INSTRUCTION TRAINING APPROACH

This application of the model for matching training approaches with training settings was made to the peer instruction training approach (Weingarten, *et al.*, 1973), considered independently of any particular training setting, in an effort to determine whether the questions on the training approach side of the model could be answered with reasonable facility for a relatively complex and comprehensive training approach. The application was made by the project principal investigator, who constructed the model, in approximately nine hours.

The peer instruction training approach in this case included both the peer instruction and the mastery testing training approaches, as described in Chapter 2 of this report, since operational peer instruction systems have included both features.

This application of the model to the peer instruction training approach was considered successful, and is discussed in Chapter 6 of this report.

Training Approach

OBJECTIVES

What is the general nature of the evidence that indicates that this training approach might improve the performance of the training system or solve the problems affecting it? (Answers to later questions in this model will explore this in more detail.) The following list describes some benefits that might be gained by adopting a new training approach:

- Reduce student attrition
- Improve job performance of graduates
- Save training time
- Reduce training costs
- Adapt course to students of lower (or higher) aptitude than previously
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A pilot test of the peer instruction system in the Army Field Wireman course at Fort Ord (Weingarten, et al., 1972) yielded substantial increases in the proficiency of graduates over the conventional course, ranging from 24% to 74% on various parts of the course. Attrition for academic reasons was reduced from 19% in the conventional course to 12.5% in the peer instruction course, and the percentage of students who were recycled through parts of the course was reduced from 30% to 0%.

In a course graduating 3,000 field wiremen per year, the time saved by these reductions in attrition and recycling (time spent in course by students who do not graduate, and extra time spent in course because of recycling) amounted to 26,940 man-days per year. At an estimated cost of $30 per man-day of training, the savings amounted to $808,200. When additional costs for equipment of $21,000 are subtracted from this figure, the net saving was approximately $262 for each graduate.

Additional savings in time and cost would have been possible from self-pacing the course and allowing students who could finish early to do so, except for statutory requirements for a minimum amount of training before soldiers could be sent overseas. Further, the peer instruction system was successful in accommodating students with a wide range of aptitude levels and backgrounds and, based on anecdotal evidence, appeared to have substantial positive effects on student motivation. The peer instruction system has been implemented in at least 12 other Army courses in the three years since the original pilot test at Fort Ord.

RESOURCES REQUIRED

A. Implications of training approach for costs.

1. What capital expenditures will be necessary if this training approach is implemented? Examples of capital expenditures—new or remodeled facilities, or equipment purchases.

   1. Some additional equipment will probably be necessary to implement the peer instruction method.

2. What kinds and amounts of operating expenses will be involved if this training approach is implemented? Areas in which operating expenses may be important include personnel, physical facilities, and instructional materials.

   2. Additional materials may be needed, to provide the hands-on performance training the method stresses.

3. If this training approach is implemented, what kinds and amounts of training development costs will be incurred? Both initial training analysis and development costs (job analysis, training content analysis, development of the instructional system, and development of the training materials) and the cost involved in repeating these analysis and development steps when the training content is changed, should be considered.

   3. Unless the course is already performance oriented, substantial work on developing outlines of the specific performances to be required of students will be necessary. Performance tests must also be developed that embody these performances.

4. When all costs of implementing this training approach are considered and these costs are distributed over the number of students likely to be trained, how does the cost per student compare with that of alternative training approaches?

   4. Data needed from a specific training setting.

5. Will this training approach permit the sharing of expensive facilities or equipment with other courses, or with operational uses?

   5. Possibly, but information needed from a specific training setting.

6. Will implementation of this training approach result in some equipment no longer being necessary?

   6. Possibly, but information needed from a specific training setting.

B. Materiel and facilities requirements for this training approach.

1. For what kinds of training locations or situations is this training approach suitable? Examples are shown in the following list (additional kinds of locations or situations should be considered if appropriate):
   - Formal school training, of a continuing nature
   - Special school training, of a one-time nature
   - Basic military training
   - On-the-job training

- Field training
- Learning resource center
- Dispersed locations
- Remote sites
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1. The peer instruction method is suitable for formal school training, and for basic military training. If operational equipment were used, the method could be adapted for use at dispersed locations and remote sites.

2. Space requirements.

a. What kinds of space are needed to use this training approach with the training content being considered? Examples of kinds of space:

- Classroom
- Laboratory
- Practical exercise facilities
- Outdoor ranges or maneuver areas
- Storage
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a. Kinds of space needed depend on kinds of performance activities required of students.

b. What amounts of the various kinds of space are needed (at least in relative terms) when comparing training approaches?

b. May need more space than conventional training to provide for student performance activities.

c. What elements in the training approach or method are related to space needs? Examples:

- One classroom for each class of ____ students.
- One terminal for each student using the system.
- One learning station for each module of content
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c. One or more learning stations, with equipment, for each segment or module of course.

d. Does the training approach require that the space to be used have special utilities or characteristics? Examples:
   - Electric power requirements
   - Air conditioning and ventilation requirements
   - Lighting requirements
   - Floor loading capacity
   -
   -

   d. Depends on performance and equipment requirements.

e. Are environmental extremes (heat, cold, humidity, etc.) important considerations in using this training approach?

   e. No, depends on performance requirements of training content.

3. What kinds of equipment and materiel are required to use this training approach with the training content being considered? The following list suggests kinds of equipment and materiel that may be needed (additional types of equipment and materiel should be listed if needed):
   - Operational equipment
   - Nonoperational equipment
   - Audiovisual equipment
   - Films, audio and video cassettes
   - Part-task training devices
   - Low-fidelity simulators
   - Large, high-fidelity simulators
   - Training aids (charts, transparencies, cut-away equipment, etc.)
   - Study guides, Technical Orders, or other printed training material
   - Job performance aids
   -
   -

   3. Equipment is required for performance-oriented training: the kinds of equipment depend on the kinds of performance involved. Minimal guidelines for the performance tasks are also required.

4. Instructional equipment and materials management.
   a. If this training approach is implemented, and equipment of any complexity is to be used in the training, does the projected utilization schedule for the equipment provide time for maintenance?

      a. Depends on specific plans in a particular training setting.

b. Is this training approach compatible with the use of training materials with a security classification?

b. Yes.

c: Does this training approach require the use of copyrighted materials?

c. It may, in some cases.

d. In planning for the implementation of this training approach, have allowances been made for the lead time necessary to obtain any needed equipment?

d. Depends on specific plans in a particular training setting.

e. Does this training approach require base support for printing, or for the preparation of slides, audio or video tapes, or other audiovisual materials? If so, has provision been made in planned schedules for the lead times involved?

e. It may; details depend on specific plans in a particular training setting.

C. Instructor requirements for this training approach. (See section on Instructional Personnel)

C. Instructor requirements for this training approach (see section on Instructional Personnel)

INSTRUCTIONAL DESIGN AND MANAGEMENT

A. Does this training approach have implications for whether the instruction shall be group paced or individually paced? The following list describes a number of kinds of instructional design:

- Group/lock step: Students receive instruction in groups and all members of a group progress at a scheduled rate.
- Group pacing: Students progress through the instruction at a rate determined by the abilities of the group as a whole. Groups of homogeneous ability levels may be formed (multiple tracks).
- Diagnostic proficiency individualization (modular scheduling): Students are tested to determine whether they need to study sections of the training content and may skip any training content that their test performance shows they have mastered.
- Remedial individualization: Students can study extra training material designed to help them make up for deficiencies in their preparation.

- Supplementary individualization: Students are allowed to work on more than one block of a course at one time. This may include outside study assignments.
- Rate individualization (self-pacing): Students may proceed at their own pace through the required training materials.
- Alternative methods or media individualization (multimedia instruction): Students have a choice (at least part of the time) as to the methods or media they use in studying the training content.

A. The method is basically self-paced, but it can be adapted to group/lock step schedules by the use of buffer periods when students perform various administrative functions in the system. Diagnostic proficiency individualization (modular scheduling), and remedial individualization is informally incorporated in the peer instruction process, as needed.

B. Does this training approach indicate that a fixed, standard level of skill or proficiency is expected of graduates of the instruction, or that each student is expected to develop his capabilities as far as he can, and in areas at least partly determined by his own interests?

B. The method has so far been used only with a fixed, standard level of skill or proficiency required.

C. Does this training approach make provision for, or have any implications for the provision of management information? The following list indicates some of the kinds of management information that might be involved:

- Information on students' backgrounds
- Information on students' progress through the course of instruction
- Information on the adequacy of various parts of the course of training
- Information on the adequacy of graduates' performance
- Information on instructional resource utilization
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C. Information on students' progress through the course of instruction and on the adequacy of the training provided by each peer instructor is available from the normal operation of the peer instruction system.

CHARACTERISTICS OF TRAINING CONTENT

A. Is this training approach suitable for the kinds of student performances that can accomplish the training objectives?

The following list of kinds of student performances can be considered when evaluating whether this training approach is suitable (any additional types or terms needed to describe the kinds of performances specified by the training objectives should be used also):

- Recall and application of facts
  - Remembering the terminology of an equipment system and the names and locations of the controls so that the student can speak or write with reasonable fluency concerning the system
  - Making specific control settings
- Serial procedures
  - Fixed
    - Energizing electronic equipment
    - Crew drill in a weapons system
  - Variable, or branching
    - Troubleshooting complex equipment using proceduralized methods and job aids
    - Emergency procedures, which often involve branching away from otherwise fixed procedures
- Tracking and aiming
  - Radar tracking
  - Aiming a gun
- Searching and scanning
  - Aircraft detection
  - Aerial observation
  - Scanning—quick search, subordinate to some other task, such as scanning instrument panel while driving.
- Discrete or continuous performance
  - Discrete—step-by-step performance, with individual steps being clearly separate elements of the performance
    - Operating control panels in missile systems
    - Assembly and disassembly of equipment
  - Continuous—cannot be divided into clearly separate elements; continuing performance, usually guided and modulated by feedback.
    - Aligning or adjusting electronic equipment
    - Riding a bicycle
- Noise-filtering—detecting cues or symptoms among a background of extraneous simulation
  - Listening to an engine to diagnose malfunctions
  - Detection of targets on radar scope

- Skilled actions—activities that the untrained person cannot perform satisfactorily, even if he is told what to do
  - Clutching and shifting an automobile with a manual transmission
  - Precision measurement with a micrometer
- Discrimination behavior—recognizing differences between objects, indications, or examples so that different responses can be made to them
  - Aircraft, tank, or automobile identification
  - Selecting one answer, example or object (solder joint, for example) as the "best" or "correct" one, according to certain standards.
- Complex perceptual-motor behavior
  - Driving a car
  - Flying an airplane
- Problem-solving—recall and application of concepts and principles
  - Troubleshooting complex equipment without proceduralized methods and job aids
  - Planning the work of a group of people and assigning tasks

A. *The peer instruction method can be used for any kind of training content, if the performances required of the student can be specified, and tests can be constructed to measure those performances.*

B. **Is this training approach suitable, considering the degree of proficiency required in the various tasks or performances that the student will be expected to accomplish to satisfy the training objectives? The following outline describes the kinds and levels of proficiency that might be required:**

- Task performance standards
  - Extremely limited—can do simple parts of the tasks but needs to be told or shown how to do most of the task
  - Partially proficient—can do most parts of the tasks but needs help on the hardest parts of the tasks
  - Competent—can do all parts of the tasks and needs only be spot-checked
  - Highly proficient—can do complete tasks quickly and accurately and can tell or show others how to do the tasks
- Task knowledge standards
  - Nomenclature only—can name parts, tools, and simple facts about the tasks
  - Procedures—can name the steps in doing the tasks and tell how each is done

- Operating principles—can explain why and when tasks must be done and why each step of a task is needed
- Complete theory—can predict, identify, and resolve problems about the tasks

- General knowledge standards
  - Facts—can cite basic facts about the subject
  - Principles—can explain relationships among basic facts and state general principles about the subject
  - Analysis—can analyze facts and principles and draw conclusions about the subject
  - Evaluation—can evaluate conditions and make proper decisions about the subject

B. The method can be adapted to any level of proficiency required of the students, by setting suitable standards on the proficiency tests.

C. Implications (or requirements) of training approach for organization of training content.

1. Does this training approach provide a basis for dividing the training content into blocks or modules?

   1. The peer instruction method, per se, provides no basis for dividing the training content into blocks or modules. This is usually done on the basis of "natural" divisions of the training content and the availability and arrangement of space and equipment in the training setting.

2. Does the training approach have any implications for the sequencing of training content?

   2. The peer instruction method has no implications for the sequencing of training content.

D. What kinds of instructional activities are implied by the training approach? The following list gives several examples of kinds of instructional activities (others should be added if they are needed):

- Presentation of knowledge
- Practice of knowledge
- Practice of performance
- Demonstration
- Provision of feedback, or knowledge of results, to students
- Provision of individual, tutorial assistance to students
- Evaluation, or training quality control
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D. The peer instruction method involves demonstration; practice of knowledge and of performance; provision of feedback and individual, tutorial assistance to students; and rigorous training quality control.

E. **What effect does this training approach have on the effort necessary to make changes in the training content? In answering this question it may be useful to consider the kinds of units or modules of content involved in this training approach, and the formats or media to be used.**

E. Changes in the training content can be made very easily with the peer instruction method. New equipment, or other changes, is inserted into the training by having the instructors teach a few students the changed content, those students then teaching other students, and so forth.

INSTRUCTIONAL PERSONNEL

A. **What roles do instructors play in this training approach? The following list describes some possible roles for instructors; others should be added if necessary:**

- Presentation of instruction (lecturing, demonstrating)
- Evaluation of student performance (proficiency testing)
- Monitoring student performance (and intervening when necessary)
- Managing the instructional system (assigning students to training activities, monitoring training equipment utilization, etc.)
- Planning and developing instruction (ISD activities)
- Conducting discussions
- Leading student activities
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A. In the peer instruction method, instructors (the staff of the training institution, not the peer instructors) evaluate student performance and manage the instructional system. Some of them may plan and develop instruction.

B. **Are auxiliary instructional personnel needed with this training approach? The following list describes some possible kinds of auxiliary instructional personnel; other kinds should be added if needed:**

- Proctors (monitoring student activities but not intervening)
- Administrative clerks (recording and processing data)
- Training equipment operators and repairmen
- Computer programmers
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B. Probably not, although it depends on the kinds of equipment used by students and their peer instructors.

C. **What special skills are needed by instructors using this training approach? The following list describes some possible kinds of special skills that might be required; other kinds should be added if needed:**

- Proficiency in the subject matter students are to learn
- Managing instructor-student relationshi[illegible]room management skills, reinforcement techniques, counselling techniques, etc.)
- Analyzing and critiquing student performance
- Relevant field experience
- Proficiency in instructional system development activities
- Operation of audio-visual equipment
- Computer operation or programming
- Writing skills
- Proficiency in evaluating student performance
- Knowledge of the relevant administrative system
- Operation and/or maintenance of operational equipment
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C. Instructors in the peer instruction system should be proficient in the subject matter students are to learn and in evaluating student performance. Proficiency in instructional system development activities will be necessary for some of the instructors, since it is desirable that those who develop the instruction go on and run the system. Field experience and knowledge of the relevant administrative system would usually be helpful.

D. **Instructional personnel management.**

1. Considering the relevant Trained Personnel Requirement (TPR) and the skills of the instructors available, will this training approach require more or fewer instructors than would otherwise be needed? Does this training approach require some minimum number of instructors to be feasible?

   1. Peer instruction will require no more instructors than would otherwise be needed, and probably will require somewhat fewer, if the number of students is relatively large. A minimum number of instructors is needed, depending on the number of modules or learning stations used in the system.

2. If the number of students is increased or decreased substantially, will additional or fewer instructors be required for this training approach? If so, in what ratio to the increased or decreased number of students?

   2. Once the modules or learning stations are staffed, the system can accommodate considerably increased numbers of students with little or no increase in number of instructors. Duplicate sets of equipment (learning stations) may be added as necessary

to accommodate large increases in the number of students, and the number of instructors needed will increase when this is done.

3. If additional instructors will be needed for implementing this training approach, have allowances been made in planning for the lead time necessary to obtain these instructors?

   3. Depends on specific plans in a particular training setting.

4. Is special or additional training required for instructors to use this training approach? The resistance to change found in almost all organizations may be a special problem in implementing a new training approach.

   4. The main special training that is likely to be needed for instructors in a peer instruction system is a thorough orientation to their role of managers and quality controllers of the training system. This role will be sharply different from that of instructors in most other training systems. An excellent way to provide this orientation is to have the instructors participate as much as possible in the development and preliminary tryouts of the system.

5. Does this training approach have any special implications for evaluating instructors? Are some instructor performances particularly critical in this training approach? Are indicators of instructor performance available with this training approach?

   5. The most important function of instructors in a peer instruction system is that of training quality control (i.e., administering and scoring the proficiency tests). Accordingly, this function should be given special weight in evaluating instructors. Indicators of instructor performance are not immediately available in the peer instruction system as it has been used in the past.

STUDENT CHARACTERISTICS

A. Numbers of students.

1. Is this training approach feasible for the numbers of students that must be trained? Does this training approach require a minimum number of students to be feasible?

   1. Peer instruction requires a minimum number of students, which is the number needed to keep the learning stations or modules operating. Larger numbers of students can easily be trained by duplicating the equipment of various learning stations or modules as needed.

2. Does this training approach deal with students in groups, or can it accommodate a more or less continual flow of students into the training course?

   2. Peer instruction works best with a more-or-less even and continuous flow of students entering training.

3. Can this training approach handle marked fluctuations in the numbers of students entering training?

   3. Peer instruction cannot handle marked fluctuations in the numbers of students entering training, except through the mechanism of a Job Surrogate, which is an instructional management center (Hungerland, et al., 1972).

4. Does this training approach utilize a basic instructional group of relatively fixed size (e.g., classroom, work, or laboratory group), so that there is a relatively fixed increment by which the number of students in training can be increased or decreased?

   4. The peer instruction uses a basic instructional group of two: the peer instructor and the student learner. Therefore, the number of students can readily be adjusted up or down, although sudden increases in the number of students entering training creates the temporary problem of too few peer instructors and throws an extra burden on the regular instructors.

B. Relationship of training approach to student aptitude levels.

1. Is this training approach especially suitable for students within a particular range of the relevant aptitudes—high, low, or middle—or is it useful for students of all aptitude levels?

   1. The peer instruction system is useful for students of all aptitude levels, mixed together.

2. Is this training approach suitable for students selected for any special aptitudes other than the four standard Air Force aptitude areas (Administrative, Electronics, General, and Mechanical), such as athletic, verbal, clerical, or space relations?

   2. The effectiveness of the peer instruction system does not depend on students being selected on any kind of aptitude, beyond the capability for elementary communication between the student learner and the peer instructor.

C. Special skills or other characteristics required of students by this training approach.

1. Does this training approach assume that entering students will already have been trained in any special skills?

   1. No, unless the training content has been developed under the assumption that students will have had training in some special skills.

2. Must students have some minimum reading level for this training approach to be feasible?

   2. No, it depends on the training content, but peer instructors have shown considerable resourcefulness in teaching various kinds of performance-oriented content.

3. Does this training approach require that students have especially good vision, hearing, or other senses? What about students with poor sensory acuity, especially those who are more or less color-blind?

   3. No, unless the performances involved in the training content require good sensory acuity.

4. Does this training approach have any implications or requirements for other student characteristics; such as physical stamina, fear of heights, volunteer vs. non-volunteer, Human Reliability, speech impediments, manual dexterity, appearance and bearing, etc.?

   4. No, depends on performance requirements of training content.

5. Can this training approach accommodate students who are unusually strong (or weak), or large (or small)?

   5. Yes.

D. Does this training approach have any implications for the sex of students, or for whether students are dealt with in sexually mixed or segregated groups? Factors that might be involved here include: different equipment or clothing requirements for women from men, or from those normally used by women; latrine facilities; quarters; etc.

D. No, this would depend on the performances required by the training content, and the circumstances under which the training was conducted.

E. Does this training approach have any implications concerning whether foreign students, or students from other services are involved in the training?

E. No, the peer instruction system has worked well with students of diverse cultural backgrounds, the only qualification being that the peer instructor must be able to communicate with his student learner in some language.

F. Does this training approach have any provisions for dealing with students who may be very poorly motivated because of malassignment or for other reasons?

F. Instructors can decide which peer instructors to assign to student learners according to any criteria that are likely to improve student performance. Informal observation of operational peer instruction systems has yielded numerous examples of stimulating and constructive peer instructor - student learner relationships that appeared to have had dramatic positive effects on poorly motivated learners.

G. Implications of training approach for student management.

1. Will it make any difference in using this training approach whether the course of instruction is of fixed or variable length for different students?

   1. No, either fixed or variable length courses may be taught, using the peer instruction system.

2. If this training approach is used, will information be available from which to predict students' dates of availability for assignment (graduation), if a variable length course of instruction is used?

   2. The peer instruction system would yield information on rate of student progress during the early portion of a course, and a predicted graduation date based on an extrapolation of the early rate of progress is a reasonable one. For a discussion of this topic, see Hunter and Wagner (1973).

3. Will use of this training approach make it necessary (or possible) for students to have periods of time before, during, or after the main body of training when they will not be occupied with training activities? If so, and students are not required to perform details or other activities not related to training, does this training approach suggest constructive uses for this time?

   3. The peer instruction system can be so arranged, and students who have finished a module of training can assist in the administration of the training system.

4. Can this training approach accommodate student absences from training activities, and the resulting need to make up missed work?

   4. Students who have missed training can be assigned to peer instructors (perhaps different ones than they started the module with) quite flexibly and thus continue their training.

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